

4.5a Graphing Secant and Cosecant Functions

Remember, $\sec x = \frac{1}{\cos x}$ and $\csc x = \frac{1}{\sin x}$.

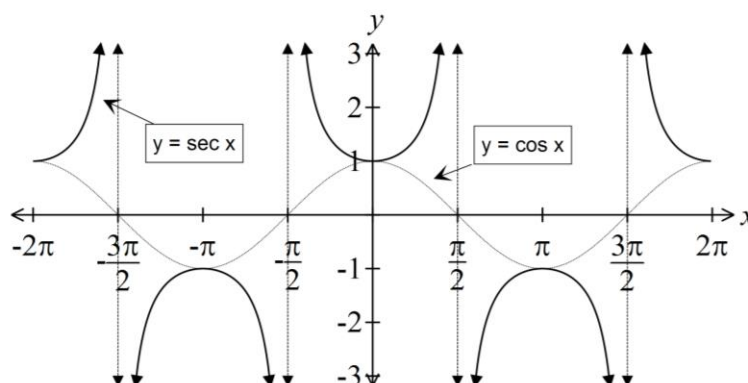
- We aren't allowed to divide by 0. This means:
 - Whenever $\cos x = 0$, $\sec x$ is undefined, and whenever $\sin x = 0$, $\csc x$ is undefined.
 - Places where $\cos x = 0$ and $\sec x$ is undefined: _____
 - Places where $\sin x = 0$ and $\csc x$ is undefined: _____
 - The graphs of $y = \sec x$ and $y = \csc x$ have vertical asymptotes at these locations.
 - **To Find the Equations of the Asymptotes:**
 - Find the smallest non-negative x where the function is undefined.
 - Add this value to k times the distance between the asymptotes.
 - $x = \text{first non-negative asymptote} + (\text{distance between asymptotes}) \cdot k$

Graphing Secant Functions

- To graph $y = a \sec[b(x-c)] + d$:
 - Sketch the graph of $y = a \cos[b(x-c)] + d$.
 - Wherever the graph of the cosine function crosses its center point, draw a vertical asymptote.
 - The local maxima of the graph of the cosine function become local minima on the graph of the secant function with $y \rightarrow \infty$ as x approaches the asymptotes on either side. The local minima of the graph of the cosine function become local maxima on the graph of the secant function with $y \rightarrow -\infty$ as x approaches the asymptotes on either side.

Key points on the graph of $y = \sec x$:

x	0	$\pi/2$	π	$3\pi/2$	2π
$y = \sec x$	1	undef.	-1	undef.	1

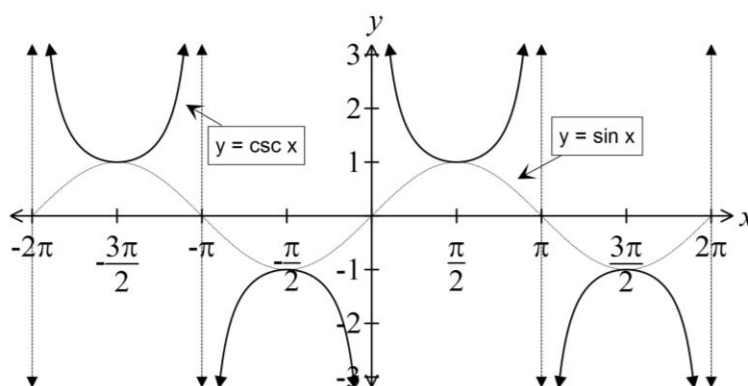


Graphing Cosecant Functions

- To graph $y = a \csc[b(x-c)] + d$:
 - Sketch the graph of $y = a \sin[b(x-c)] + d$.
 - Wherever the graph of the sine function crosses its center point, draw a vertical asymptote.
 - The local maxima of the graph of the sine function become local minima on the graph of the cosecant function with $y \rightarrow \infty$ as x approaches the asymptotes on either side. The local minima of the graph of the sine function become local maxima on the graph of the cosecant function with $y \rightarrow -\infty$ as x approaches the asymptotes on either side.

Key points on the graph of $y = \csc x$:

x	0	$\pi/2$	π	$3\pi/2$	2π
$y = \csc x$	undef.	1	undef.	-1	undef.



Examples: Graph the following functions. Find the period, asymptotes, and range of each.

$$y = 3 \sec(2x)$$

$$y = \csc\left(x - \frac{\pi}{4}\right) + 2$$

$$y = \sec\left(\frac{1}{2}x + \frac{\pi}{6}\right)$$

$$y = 2 \csc\left(\frac{\pi}{4}x + \frac{3\pi}{4}\right)$$